

ANNEX 3 TROUBLE SHOOTING

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- 3. Troubleshooting**
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1. Electric parts

It is compressor and motor fan that finally drives after power is supplied. And it is necessary to check the internal factors like switches, protectors, or lead wires that are needed to reach the compressor and motor fan to see if their connections are normal and the external factors to see if voltage is normally supplied.

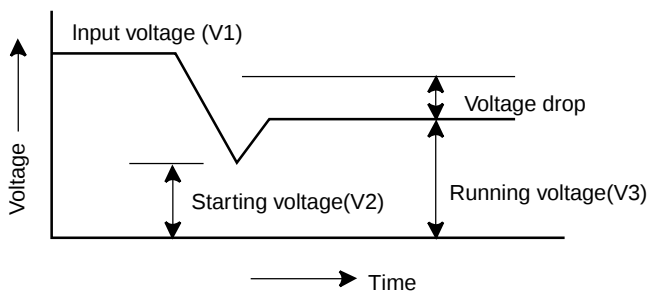
1.1 External factors check

1) Working power and voltage drop

The rated voltage for airconditioner is specified in a workable range.

In order to operate airconditioner normally, it is desirable for the working voltage and minimum. starting voltage to be within the following chart range.

Especially, just the fact that the voltage when airconditioner is not at work is within the working voltage range is insufficient, and the voltage is sure to be within the working voltage range by measuring in a operating condition.



* Usable voltage = Product rating $\pm 10\%$

2) Electric wire capacity

The electric wire for airconditioner should have an allowable current more than the load current of the circuit and be able to control the voltage drop by the load current within 2%.

And it should be a thickness capable of keeping the voltage drop by a starting current within -10%, and especially for an airconditioner of single phase, the voltage drop (Flicker voltage) by the starting current be within about 5%.

A = $V1 - V2$: Voltage drop by the starting current of airconditioner (Flicker voltage)

B = $V1 - V3$: Voltage drop by the normal running current of airconditioner

$$\frac{V1 - V3}{V1} \times 100 \leq 2\% \text{ (B case)}$$

$$\frac{V1 - V2}{V1} \times 100 \leq 5\% \text{ (A case)}$$

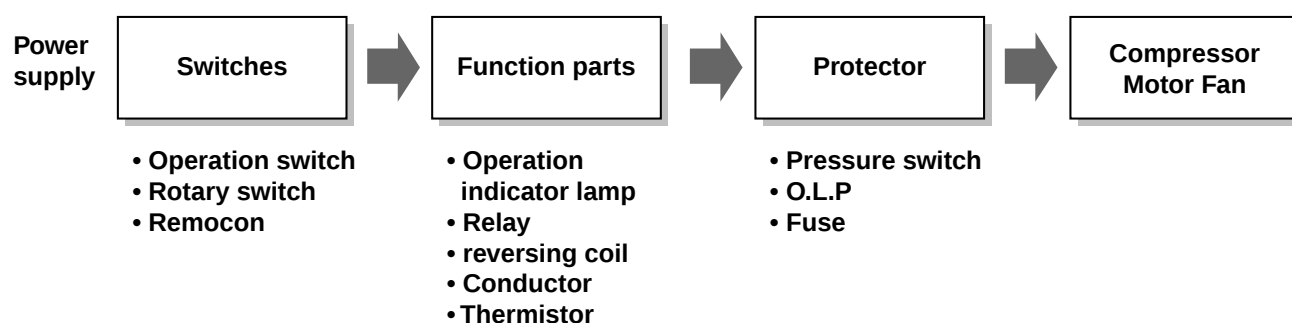
In case of using an airconditioner in a low voltage area where power supply voltage is low, especially, the Flicker voltage due to inadequate wires may cause the fluorescent light to be off or may affect the other electric products. So, care should be taken to the wiring work.

3) Wire thickness required

Rated current appliance(A)	Nominal cross-sectional area(mm ²)
Up to and including 6	0.75
Over 6 up to and including 10	1.0
Over 10 up to and including 16	1.5
Over 16 up to and including 25	2.5
Over 25 up to and including 32	4.0
Over 32 up to and including 40	6.0
Over 40 up to and including 63	10.0

For rated currents up to 3A, a nominal cross-sectional area of 0.5mm² is only allowed if the length of the cord does not exceed 2m.

1.2 Internal factors check



1.2.1 Insulation resistance

Measure the insulation resistance between live part and dead metal part by 500V insulation resistor to check if the insulation resistance is more than 10MΩ.

1.2.2 Insulation resistance measurement of compressor

Measure the insulation resistance of compressor between compressor terminal and dead metal part by insulation resistor, and the insulation resistance should be above 10MΩ.

Compressor may change the insulation resistance while running. Accordingly, measure the insulation resistance just after running as needed.

- **Note:** For R-22 used in airconditioner, the dielectric rate on liquid state is high. If a contaminant is mixed into R-22, the electric resistance is extremely low and the poor insulation is occurred. Accordingly, be sure to prevent contaminants from mixing into refrigerant system.

1.2.3 Running capacitor

1) Earth inspection between terminal and body

As shown in Figure 1, connect a resistor between one side terminal and body of condenser to check for continuity.

2) Capacity inspection

(1) Remove the lead wire from both terminals of condenser to be checked.

(2) Contact both terminals of lead wire for 2-3 sec., and discharge.

(Be sure to perform to prevent the tester damage before measuring.)

(3) After discharging, contact both terminals of tester with the terminal of condenser to see the dial vibrating direction of resistor. (See Figure 2.)

There are three kinds of dial vibrating direction in tester, and each vibrating direction and symptom is as follows.

A: Normal : Dial shakes instantaneously and returns to the original state immediately.

B: Short : Dial remains moved.

C: Capacity consumed up : Dial does not move at all.

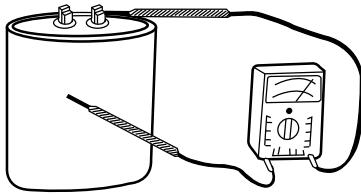


Figure 1.

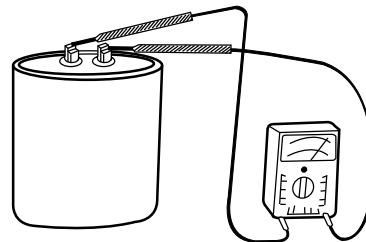


Figure 2.

1.2.4 Motor fan

1) Power off, remove motor fan, and test independently.

2) Measure the resistance of main coil, sub coil and control coil in motor.

3) Use a good quality of capacitor in testing.

4) Diagnose the following troubles by the independent test, and replace motor.

a) Motor is not started.

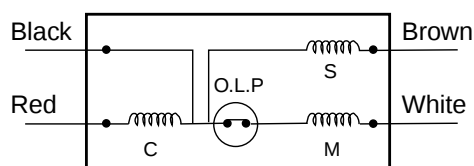
b) Motor rotation rises very slowly.

c) Bearing failure : The shaft does not move.

d) Arc occurs in the motor inside.

e) Smoke emits from motor inside.

f) Excessive noise



Measuring main coil resistance : White ↔ Black

Measuring sub coil resistance : Brown ↔ Black

Measuring control coil resistance : Red ↔ Black

1.2.5 Thermostat

There are 3 kinds of thermostat malfunction.

- 1) Leak of gas charged in sensor part
- 2) Short of contact point
- 3) Wrong wiring

Switch off at room temperature 18-30°C, turn carefully the knob of thermostat from 1 to 10 (the number may be different or a figure be used according to model) or reversely, and click sounds.

After the sound is heard, turn reversely to check again the click sounds.

If click sounds, the thermostat is in normal. If room temperature exceeds 30°C, test should be done after cooling by putting the sensor part of thermostat into a cold water container because the contact point is not opened.

If knob is turned but click does not sound, remove the thermostat cover and examine the contact point.

The fused contact point should be replaced with a new thermostat.

If contact point is not closed despite of the sensor temperature being sufficiently high, the gas at the sensor part may be leaked. In this case, replace the thermostat.

When replacing thermostat, be sure to conduct after performing carefully as the above content.

1.2.6 Thermistor

Pull out the lead wire of thermistor terminal to test continuity.

Connect a tester to the terminal of thermistor and measure the resistance. The resistance value varies according to the measuring condition and temperature, so in order to vary temperature forcibly, put water in a cup, cool the sensor part of thermistor, and then measure the resistance, and also measure in a condition that the sensor part of thermistor becomes warm by hands.

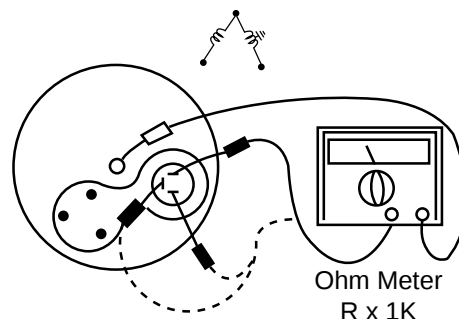
1.3 Compressor trouble diagnosis

1.3.1 Electrical troubles

1) Ground test

Test single phase and three phase in the same manner.

- (1) Shut off the power supply to product.
- (2) Remove the wires connected to the compressor terminal.
- (3) Clean the compressor terminal and discharge (suction) pipe.
- (4) Measure the resistance of discharge (suction) pipe and each terminal by using a R x 1K scale of Ohm meter.
- (5) If dial moves remarkably, the terminal is in ground state. So, replace the compressor.



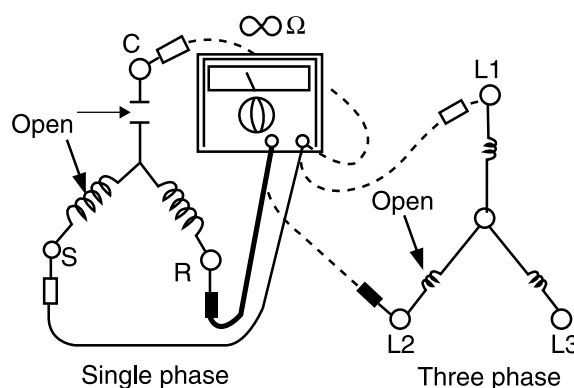
2) Wrong wiring check of compressor terminal

Examine the wiring diagram of compressor terminal or the electric circuit diagram of product on the cover of compressor terminal to check if there is wrong wiring.

3) Checking of wire disconnection or overload protector (O.L.P) operating condition

This check is to see the wire terminal condition of motor inside, and for a single phase compressor with O.L.P built-in, it identifies the O.L.P operating condition and wire disconnection.

- (1) Shut off the power supply to product.
- (2) Remove the wires connected to the compressor terminal.
- (3) After checking the ground state, cool the compressor sufficiently.
(at room temperature)
<For single-phase compressor>
- (4) Measure the resistance of each terminal by Ohm meter R x 1K scale, and if dial does not move, compressor is in opened condition.
<For three-phase compressor>
- (5) Measure the resistance of each terminal by Ohm meter R x 1K scale, and if dial does not move, the wire between two terminals is disconnected.
-> Action: Replace the compressor.



* OLP may be operated by the following causes, so be sure to find and remove the cause.

- (1) Operation at low voltage
- (2) Defects of operation or starting device
- (3) Overheat of compressor motor due to the condensing coil closing, condensing motor defects, liquid line close, or injection capillary close.

1.3.2 Mechanical troubles

1) Not starting

- (1) Phenomenon : Compressor is not started but the starting current continues to flow.
- (2) Checking
 - a) Check capacitor. (for a type where a capacitor for compressor starting or operating is used)
 - b) If there is no trouble, it is judged as lock due to the wear of compressor inside or the damage of lubricating device. Replace the compressor.

2) Poor compression

- (1) Phenomenon : Compressor is at work, but the cooling capacity is weak, the pressure of high pressure side is low and the pressure of low pressure side is high.
- (2) Cause : Damage of valve in compressor inside, damage of connecting rod or crank shaft, or other internal leak
- (3) Checking
 - a) Stop and then start the condenser fan, and if the pressure of high pressure side does not increase, the compressor is bad.
 - b) Measure the temperature of discharge pipe in compressor, and if it is abnormally low temperature (50°C or less), the compressor is bad.
 - c) Conduct the pump down test of system to check the compression capacity.
 - Power off the product.
 - Close the service valve of liquid line. (Rotate the valve rod clockwise to close the valve rod.)
 - Start product and observe the suction pressure.
 - If compressor is normal by pumping down the system, pressure is kept 0-5 psiG (0-0.35kg/cm².G), and if the suction pressure increases, the compressor is bad due to the internal leak or valve damage.
- (4) The compressor to be assumed as bad compression should be replaced.
 - If running for a long time in a bad compression condition, abnormal superheat may occur and the compressor motor is burnt.
 - Clean the cycle.

3) Overcurrent flowing while running

Check the working pressure, and if there is no trouble, it is assumed as the compressor bearing damage. Replace the compressor.

(Excessive refrigerant charging may cause the overcurrent.)

2. Refrigerant system

2.1 Refrigerant system troubleshooting

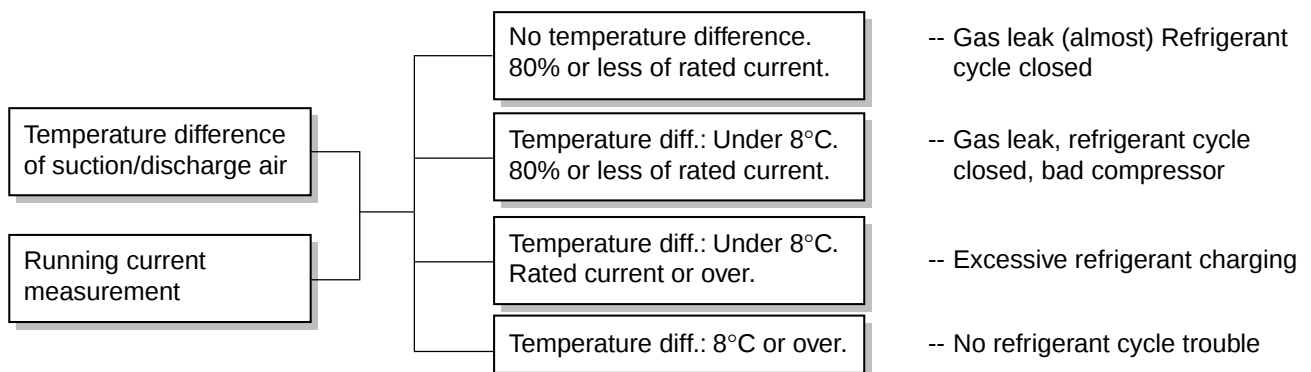
Check the following items when troubleshooting the refrigerant system.

- 1) The thermostat setting or remocon temperature setting is not wrong?
- 2) Air filter is not cleaned?
- 3) Blower fan control switch is not at "low"?
- 4) Ventilation lever is not opened?
- 5) There is no obstacle in suction or discharge side of outdoor unit?
- 6) Dirty heat exchanger causes the heat exchanging efficiency to be down?
(Thorough cleaning)
- 7) Cooling/heating load is not increased?
- 8) Too many persons are in room? (Cooling)
- 9) The insulation of window gap is not wrong?

If there is no trouble from the above checks and also if there is no trouble on the electric appliances of airconditioner body, it is assumed as refrigerant system failure.

- a) Set aircon to High cool, run cooling for 15 min. or more, and measure the temperature difference of suction/discharge air in indoor unit. (Adjust the wind direction so that wind is discharged to the front direction in the installed condition.)
- b) Measure the voltage and current in running condition.
- c) Measure the pressure of low pressure side in cooling condition.
(If the temperature is low, convert into the test switch.)

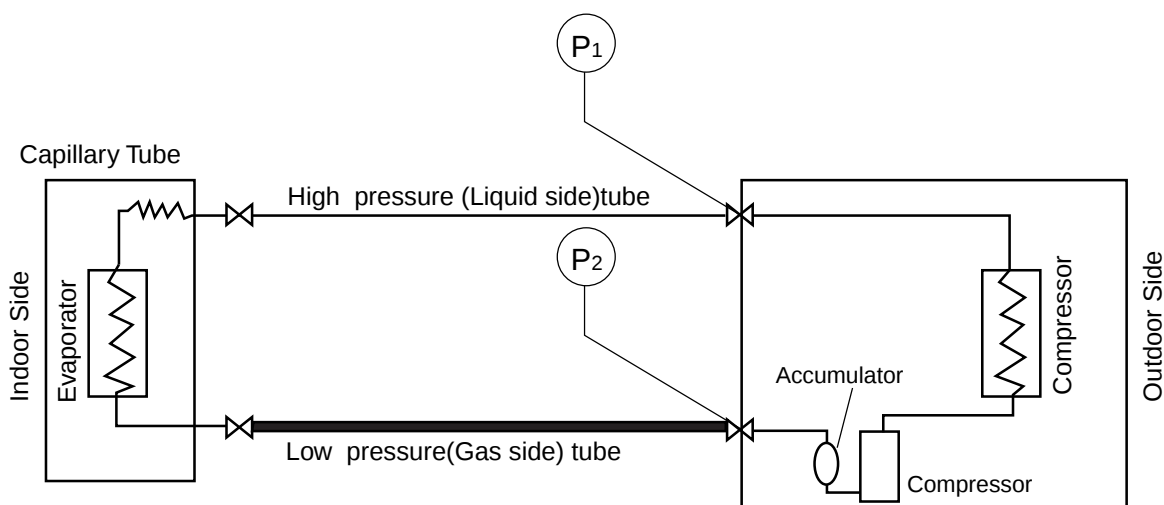
2.1.1 Temperature difference and current of suction/discharge air in evaporator



• Temperature difference of suction-discharge air

Normally, the temperature difference is based at 10°C. Actually, the judgement criteria is 8°C, because when the room humidity is high, the temperature difference is small and when humidity is low, it becomes large.

2.1.2 Pressure and temperature of refrigerant



The pressure in normal condition shows the figure in the right side table, but the pressure (P1) of high pressure side tube is affected greatly by the temperature change and about 16kg/cm².G in a low temperature condition (indoor/outdoor 21°C).

The pressure fluctuation is affected by the tube length or insulation as well as temperature change, so measure the pressure (P2) of low pressure side for the trouble shooting of refrigerant system.

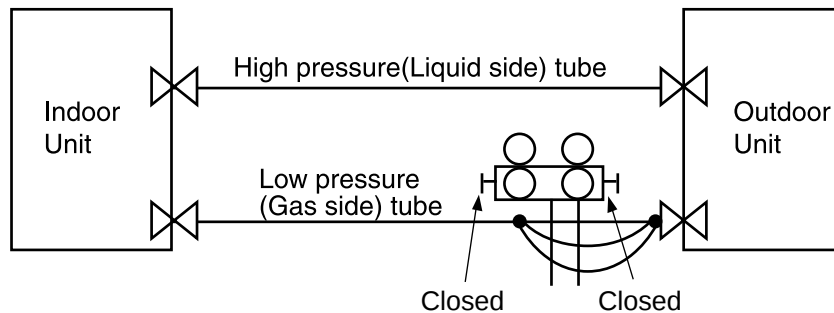
Measuring place	Pressure(kg/cm ² G)
P1	About 19.5
P2	About 5.0

<Trouble finding by pressure/temperature>

Pressure (than normal)	Temperature (than normal)	Cause	Explanation
Higher	Higher	Bad compression: Compressor failure, Bad reversing Valve	Current flows weakly.
	Normal	Cooling load is small.	Current flows weakly.
		Liquid refrigerant suction: Excessive refrigerant charging	High pressure is not increased rapidly in early running stage.
Lower	Higher	Gas short : Gas leak	Current is low.
		Closed : Pipe internal	Current is low.

Note) The high/low temperature is a figure converted into pressure.
The low pressure is normally 4.5-6.0kg/cm².G.
(Temperature is normally 3°C-10°C.)

• Pressure measurement of low pressure side



As shown in Figure above, connect the manifold gauge to the low pressure (gas side) tube of condenser and measure the pressure.

2.1.3 Symptoms and actions

1) Short of refrigerant

The short of refrigerant appears in a slightly different symptom as (1) no refrigerant or (2) short of refrigerant.

(1) Symptoms : The temperature difference of suction-discharge air is 8°C or less, the running current is less than the rated current, and the pressure of low pressure side is low. (These are symptoms changed by short of refrigerant.)

(2) Judgement method : Frost is formed from the capillary tube outlet to the evaporator inlet.
The suction pipe of compressor is not cold. (The temperature of suction pipe is similar to the outdoor temperature.)
The pressure of low pressure side in cooling is 4kg/cm².G or less. (Surrounding temperature : 30°C or over)
Refrigerant oil comes out from the evaporator-condenser connections and each welded portion. (Finding the gas leak place)

(3) Actions:

- ① Find the gas leak area. (Check at balance pressure of 5kg/cm².G or over.)
- ② Charge refrigerant to the specified level.
- ③ Check for gas leak.

2) Closing of refrigerant system

(1) Symptoms : If the refrigerant system of strainer or capillary tube is closed, pressure drops at the outlet of closed area, and refrigerant evaporates to form and attach dew or frost.
The running current is less than the rated current, and the pressure of low pressure side is lower than the normal. If completely closed, the pressure of low pressure side is to be 0kg/cm².G as time goes by.

(2) Judgement method : The same symptoms as the short of refrigerant appears, and the same phenomenon occurs even if refrigerant is sealed.
It takes 3 min. or more for refrigerant to balance.
If running in the condition, the temperature of discharge gas becomes higher, the refrigerant oil is deteriorated, and the life time may be affected.
(Compressor motor may be burnt.)

3) Overcharge

(1) Symptoms

- The temperature difference of suction-discharge air is 8°C or less, the running current is higher than the specified current, the pressure of low pressure side is high, and the compressor and suction pipe are cold.
- If running in the condition, pressure switch activates at overload operation to make continuous operation impossible, compressor is difficult to start, and fuse or breaker is easy to be disconnected.

(2) Actions

- ① Discharge the refrigerant. (By $3\text{--}5\text{kg}/\text{cm}^2\text{G}$)
- ② Charge refrigerant to the specified level.
- ③ Check for gas leak.

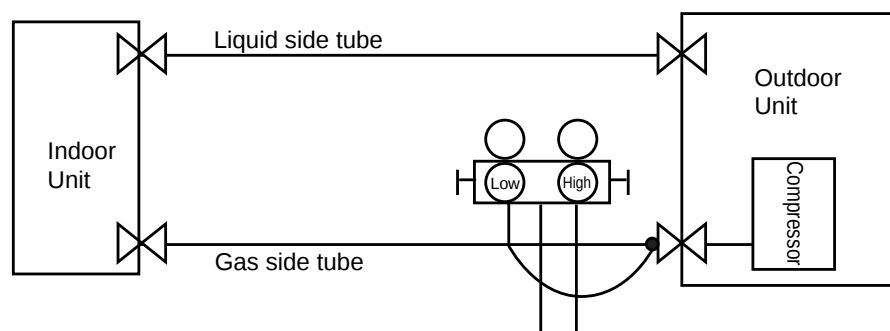
4) Bad compression

(1) Symptoms

- The temperature difference of suction-discharge air is little, the running current is less than the specified current, the pressure of high pressure side is low, and the pressure of low pressure is high.

(2) Judgement method

- Close service valve of high pressure side in condenser (front seat) and connect the manifold gauge to the service valve of low pressure side. (Close the valve.)
- If the dial of pressure gauge does not indicate $0\text{kg}/\text{cm}^2\text{G}$ or less by cooling in the condition, the compressor is judged as bad.



Note) If pressure gauge is near $0\text{kg}/\text{cm}^2\text{G}$, immediately stop the cooling.

Otherwise, air flows into the refrigerating cycle or the compressor motor coating is taken off to cause the poor insulation. So, care should be taken.

2.1.4 Summary of check items by cause

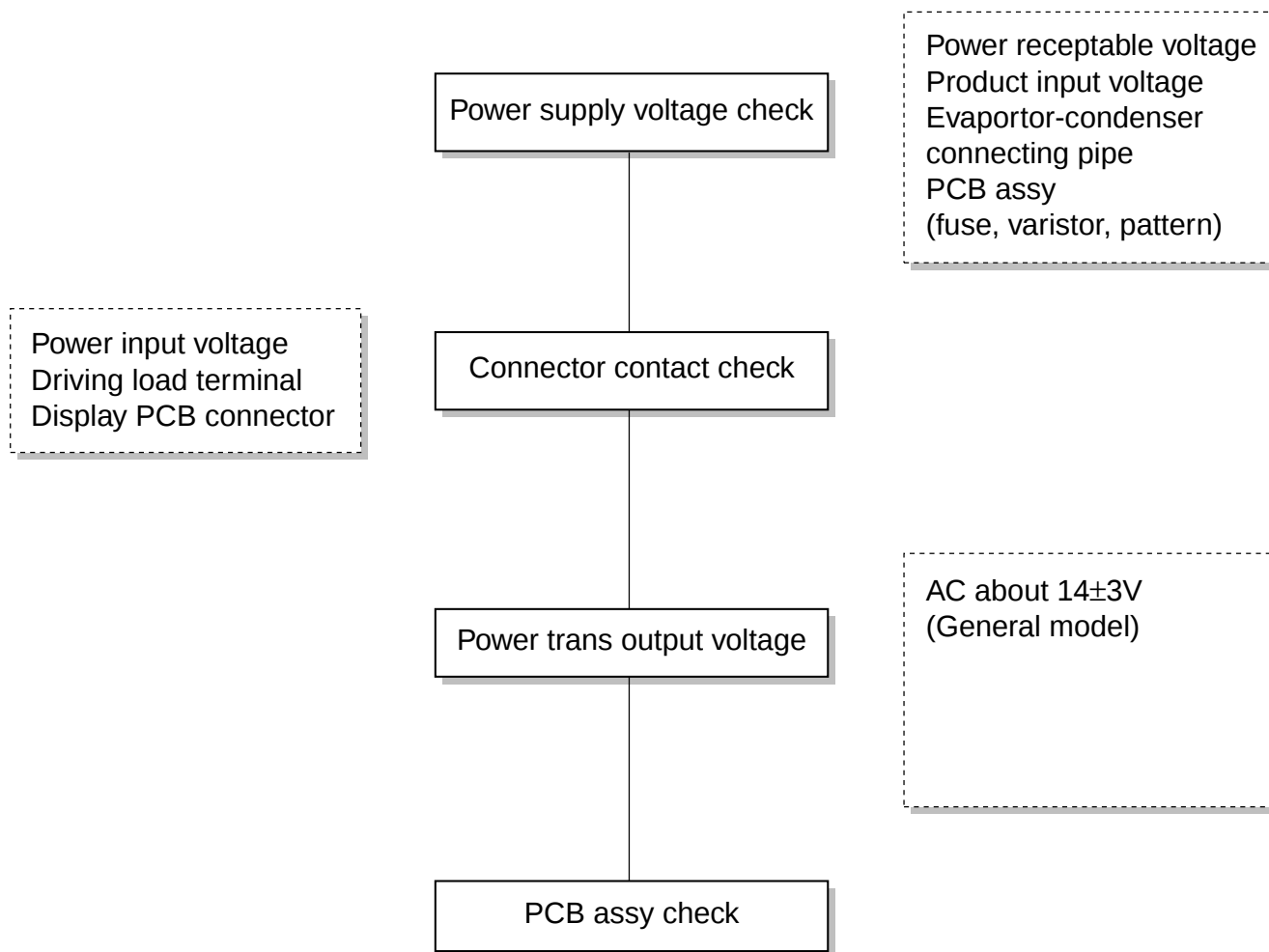
Cause \ Check item	Suction/discharge air temp.diff. of evaporator		Rated current		Low pressure		High pressure	
	Cooling 8°C	Heating 14°C	Cooling	Heating	Cooling	Heating	Cooling	Heating
Short of refrigerant	☐	☐	☐	☐	☐	☐	☐	☐
Capillary closing (a part)	☐	☐	☐	☐	☐	☐	☐	☐
Outdoor heat exchanger contaminated	☐	☐	☐	☐	☐	☐	☐	☐
Indoor heat exchanger contaminated	☐	☐	☐	☐	☐	☐	☐	☐
Bad compressor	☐	☐	☐	☐	☐	☐	☐	☐

2.2 Precautions on repair

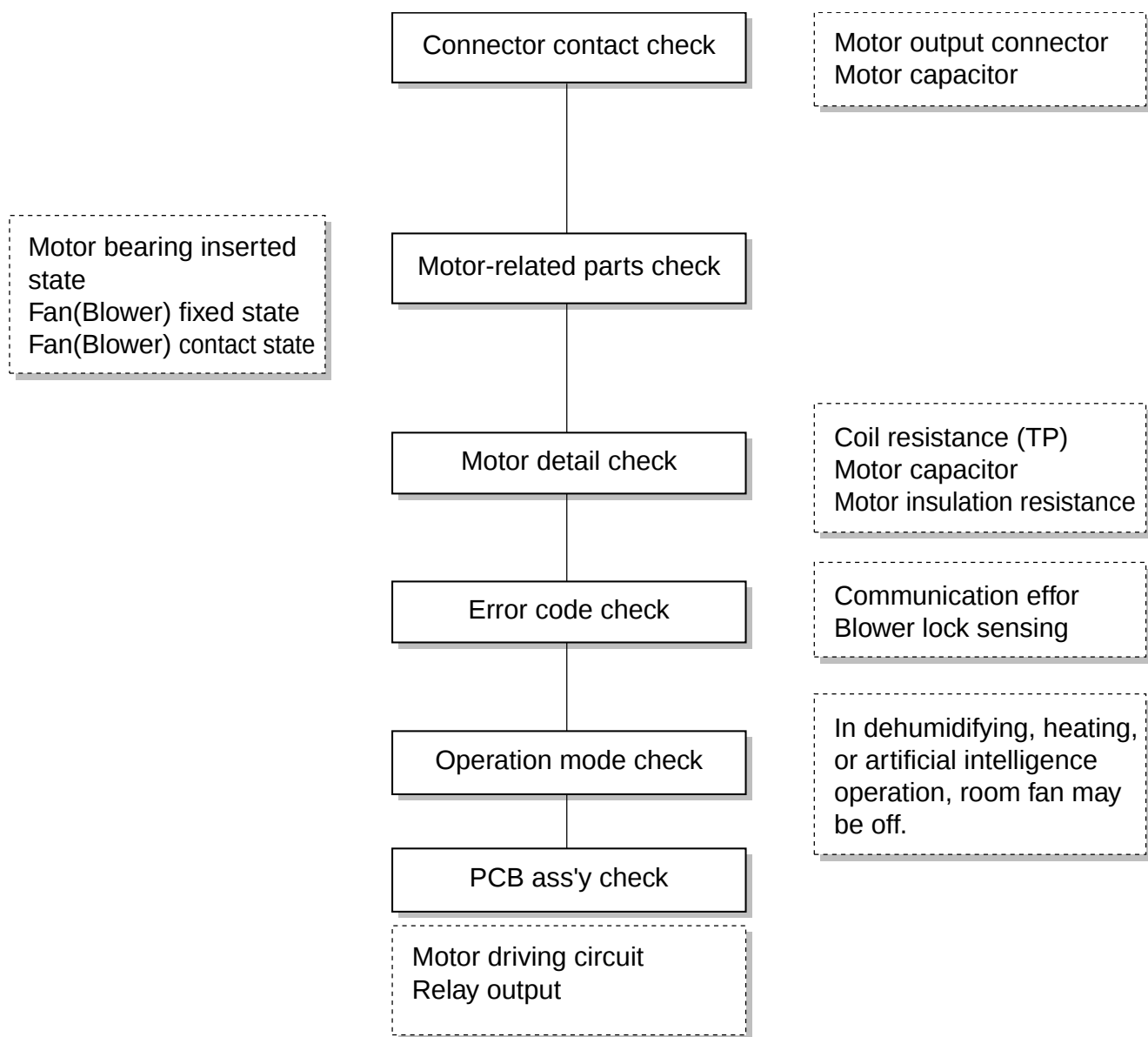
- 1) When discharging refrigerant (from pipe or body), the discharge outlet should direct the direction where nobody exists.
- 2) Do not work near fire or flame.
- 3) Work in a large space if possible and arrange the scaffold.
- 4) Especially for working on rooftop, prepare a place to keep tools and take care to prevent from falling.
- 5) While running (pump down work, test run), do not insert hands into fan.
- 6) Clean the Indoor-outdoor connecting pipes and the manifold gauge edges to be free from dust or moisture.
- 7) Be sure to fill refrigerant to the specified level. (If refrigerant is too much or short, the capacity is down and trouble may occur.)
- 8) Keep tools well, and check the measuring machine periodically.

3. Troubleshooting

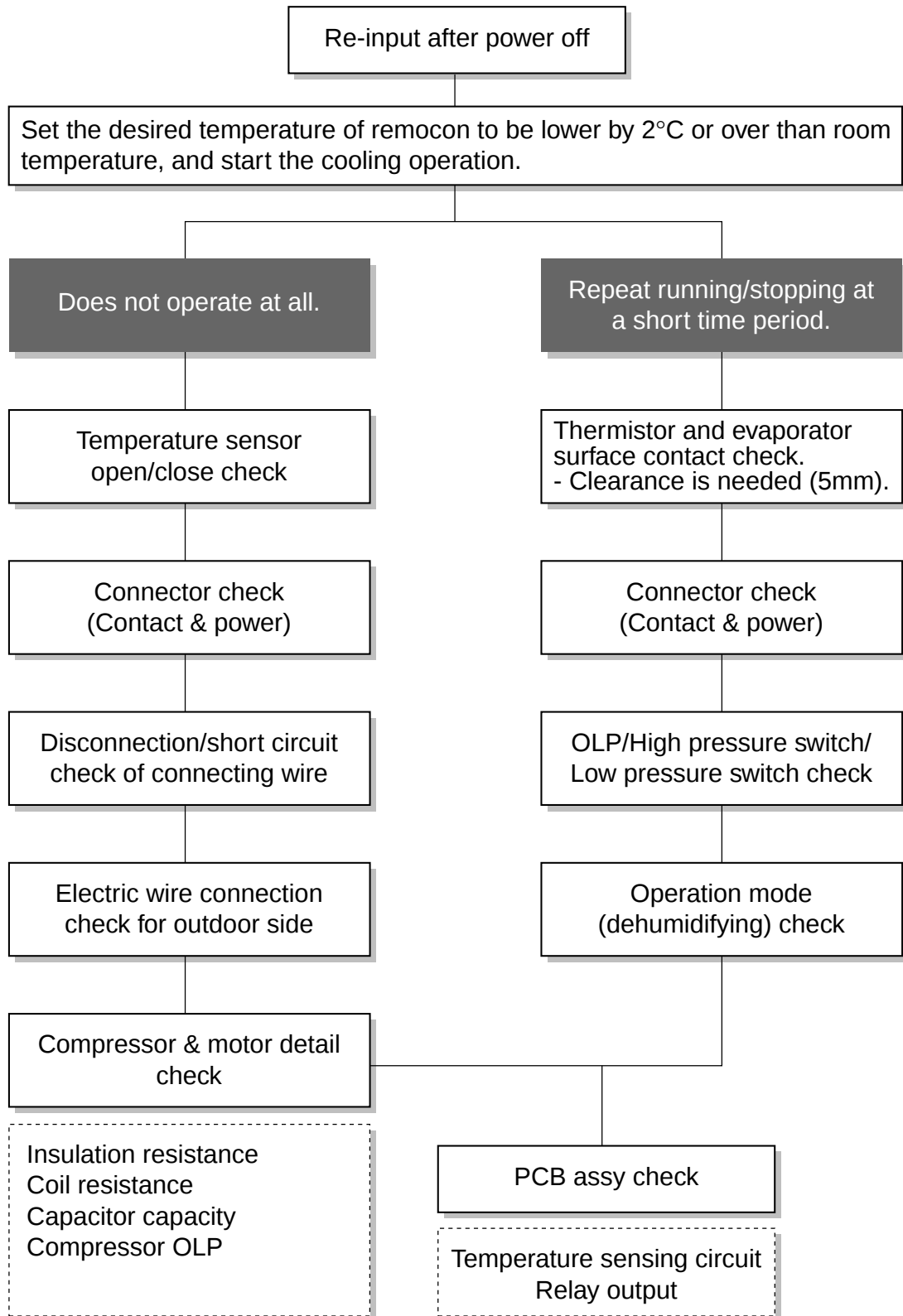
3.1 Product does not operate at all.



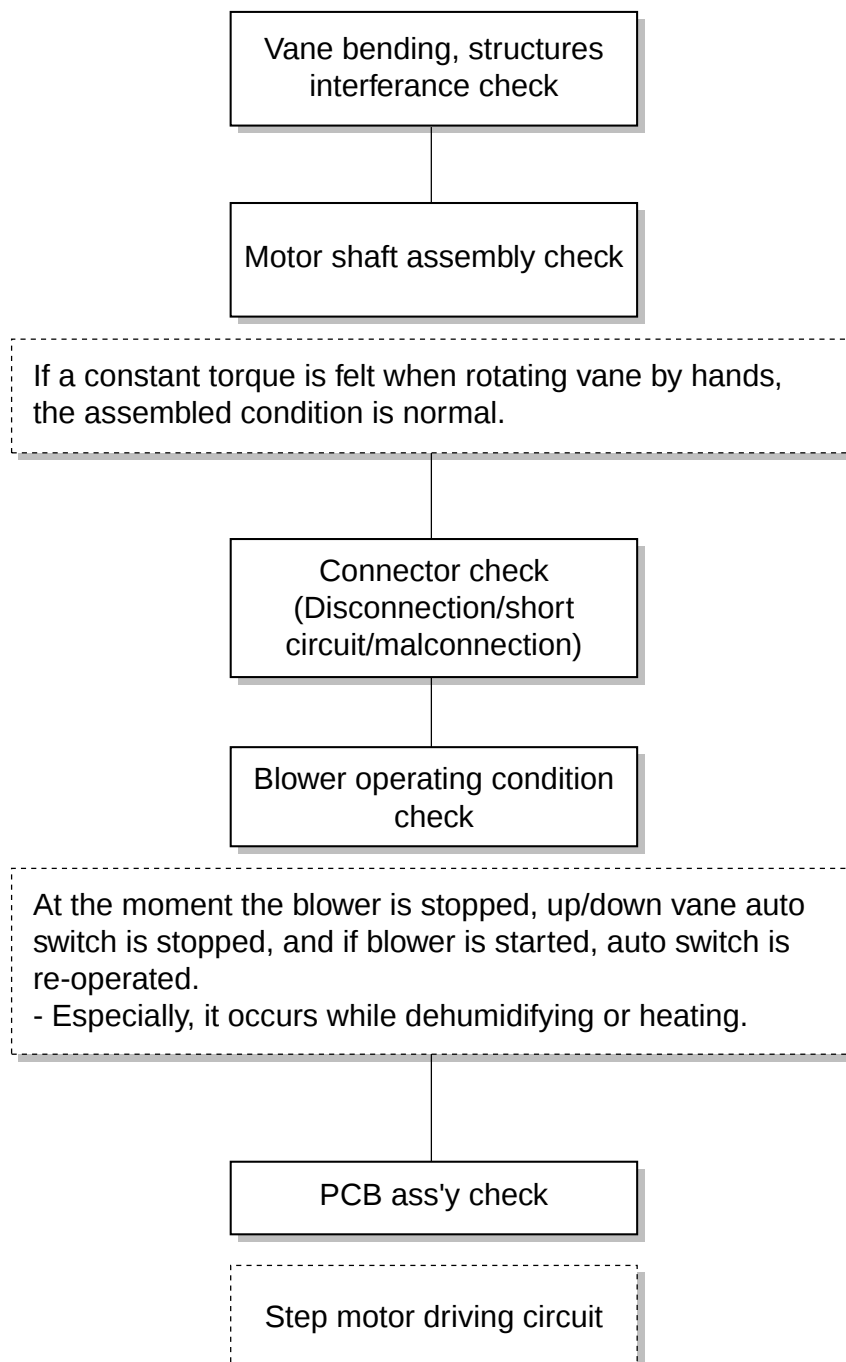
3.2 Room fan does not operate at all.



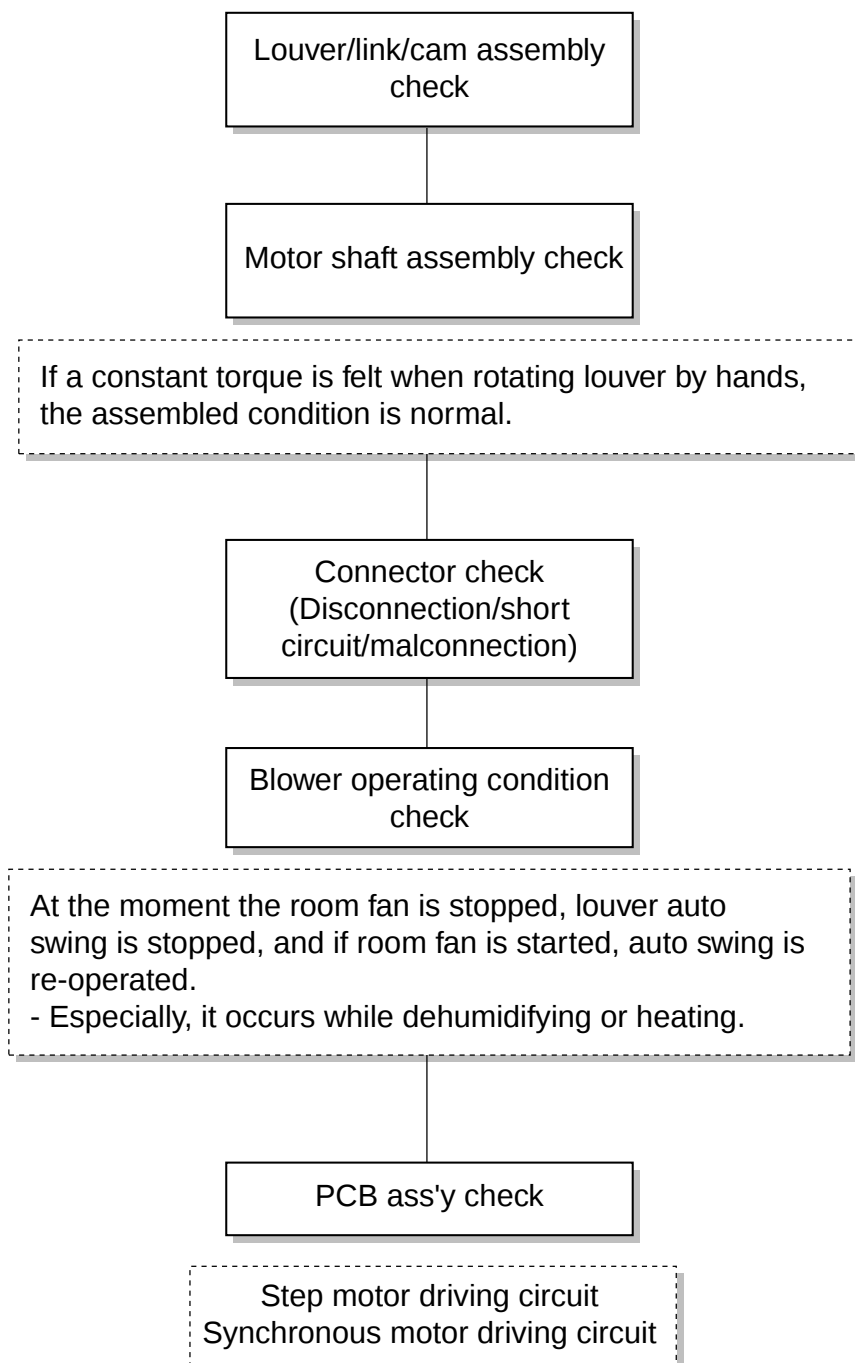
3.3 Compressor or outdoor fan does not operate at all.



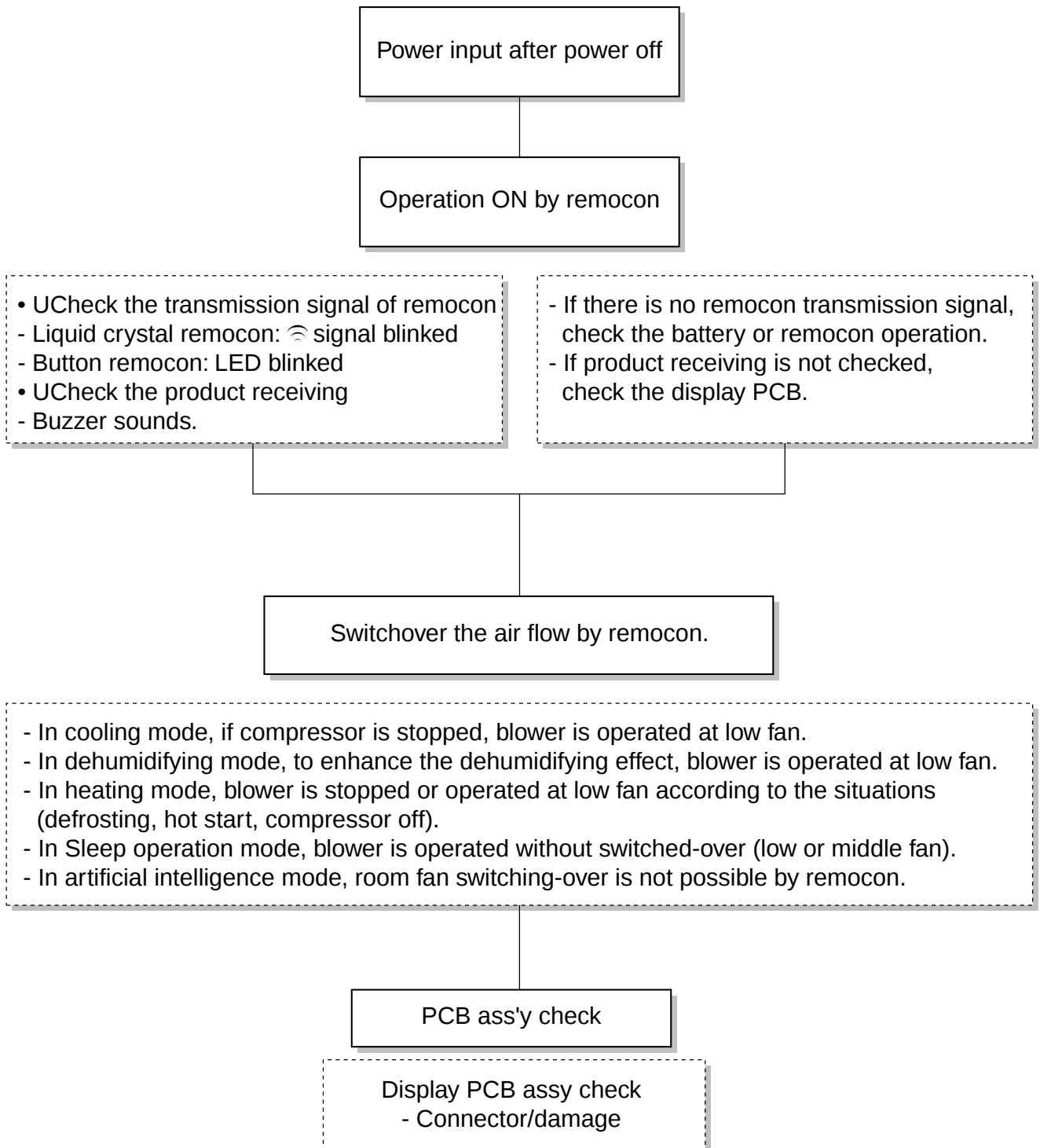
3.4 Up/down vane does not operate at all.



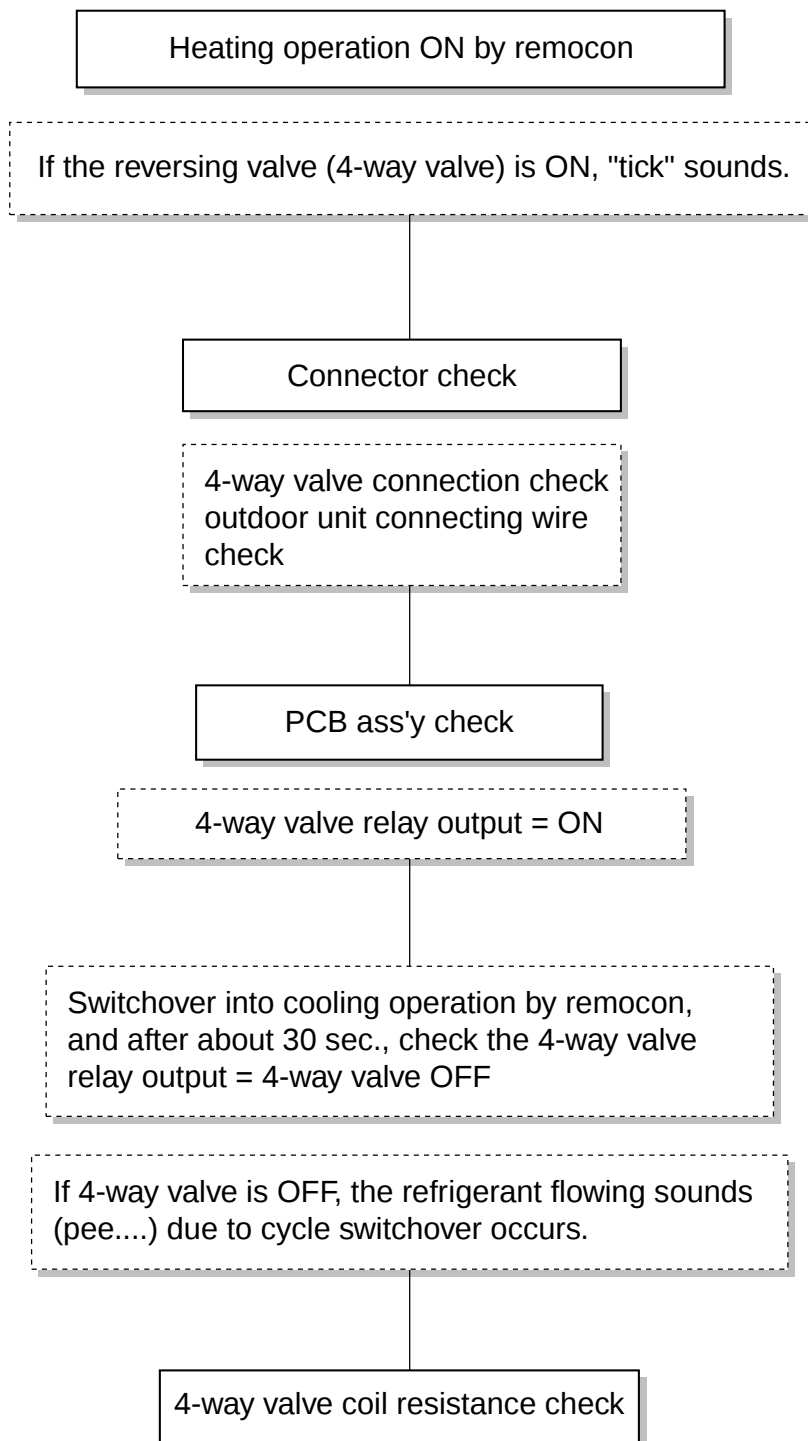
3.5 Left/right louver does not operate at all.



3.6 Function setting by remocon is disable.



3.7 Cooling/heating conversion is disable.



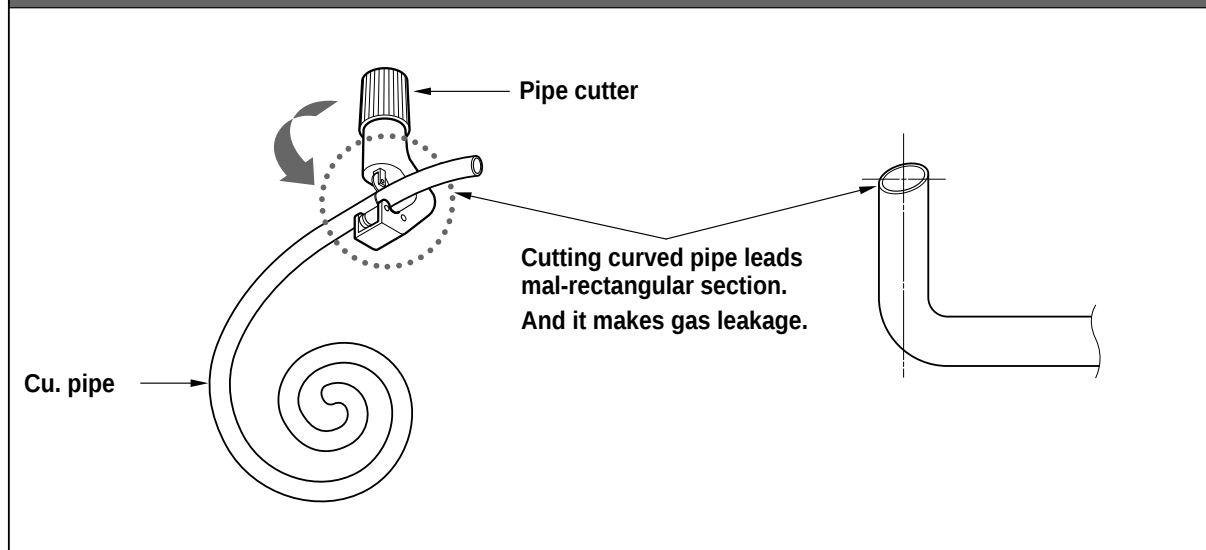
4. Installation Fundamentals

Leakage /Freon - 1/4

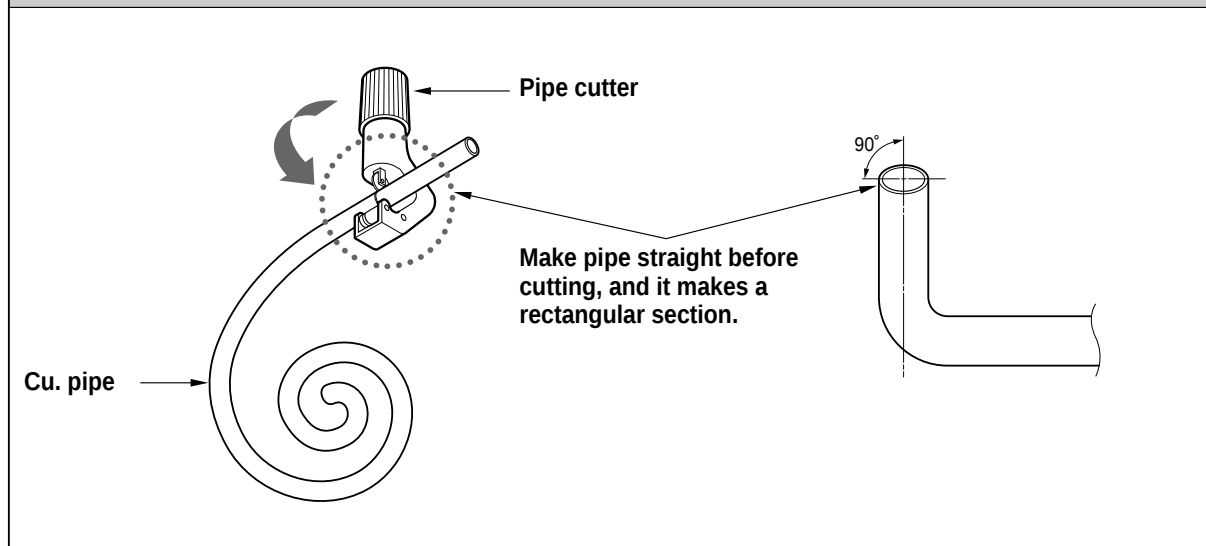
Case-1

Key Factor	Pipe cutting
Troubles & Causes	Gas leaks due to the mal-flared copper pipes with non-rectangular section.

Defect Details

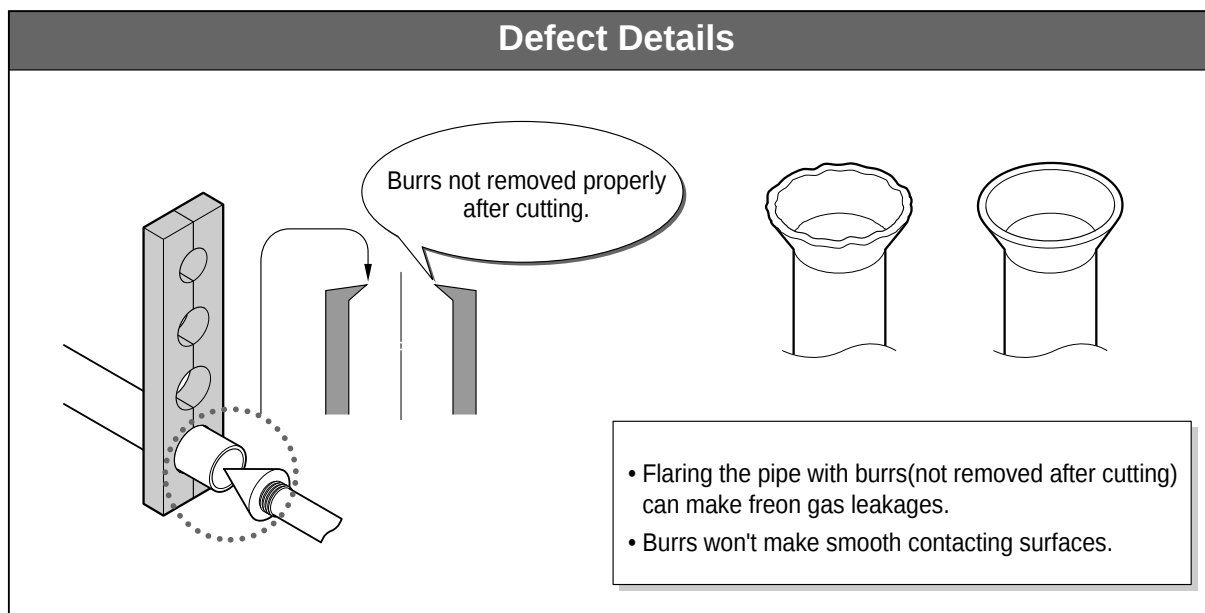
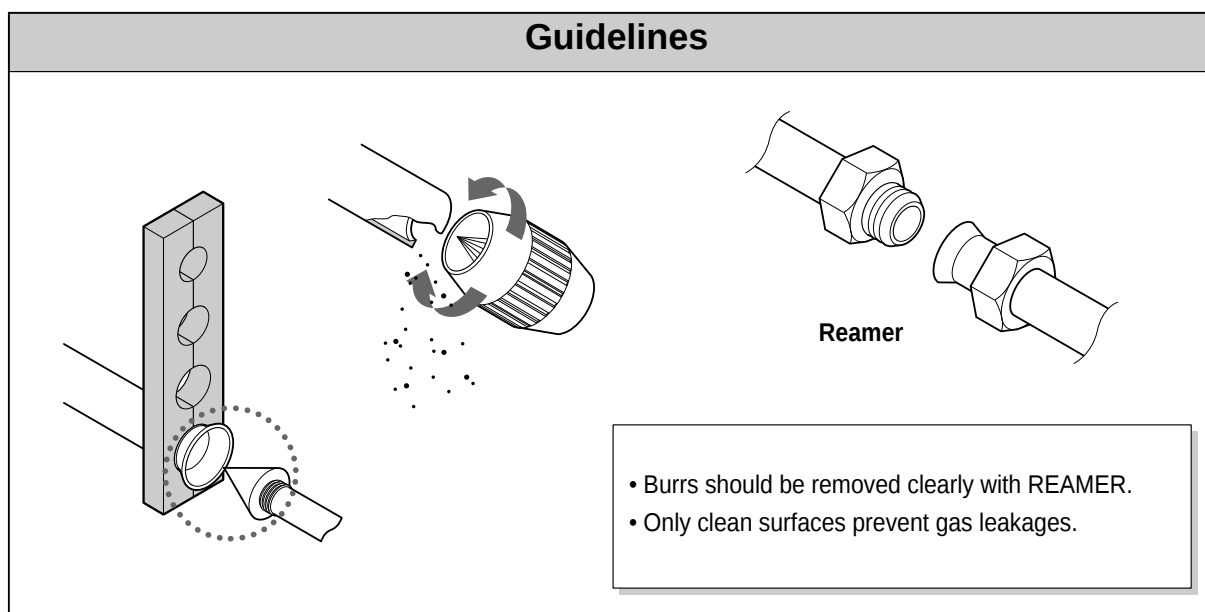


Guidelines



Leakage /Freon - 2/4**Case-2**

Key Factor	Removing burrs of pipes.
Troubles & Causes	Gas Leaks due to the burrs caused by cutting and not removing properly.

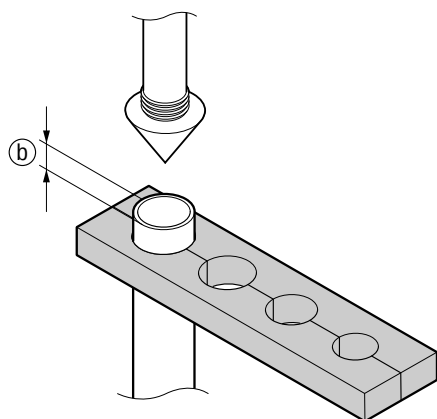
Defect Details**Guidelines**

Leakage /Freon - 3/4

Case-3

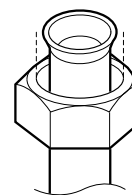
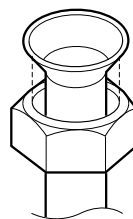
Factor	Flaring works
Troubles & Causes	Gas leaks and connecting troubles on tubings caused by the inaccurate sizing during flaring works.

Defect Details



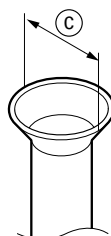
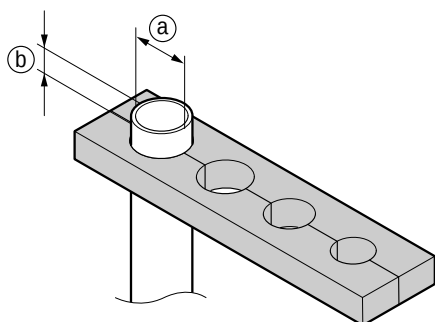
Pipe worked with large sized **(b)** won't be assembled into the nut.

Pipe worked with small sized **(b)** will make small contact with nut and gas leak against even a weak shock.



Guidelines

Recommending sizes for several pipes which make proper connectings.



unit:mm

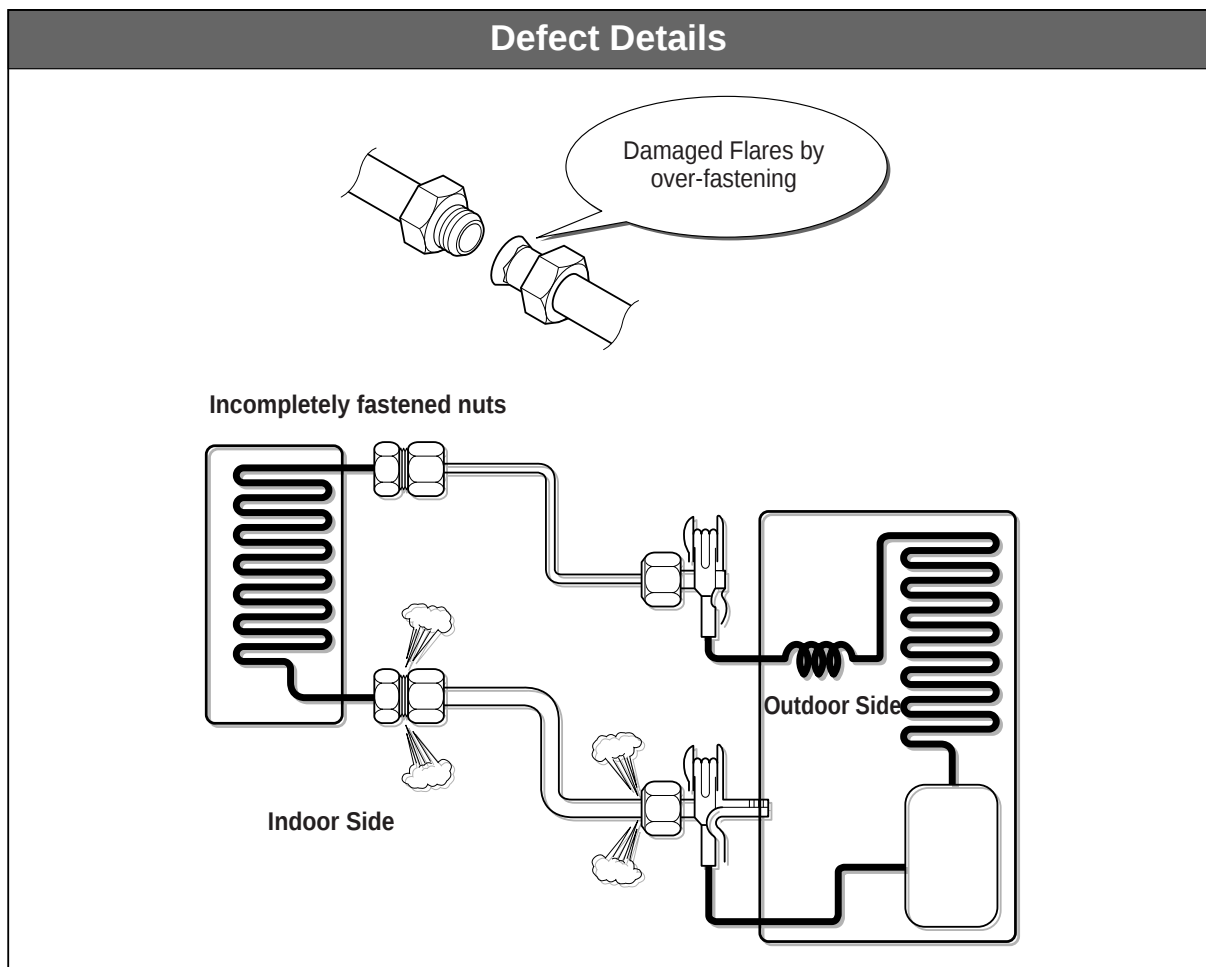
(a) Pipe dia.	(b) Hight	(c) Flared dia.
ø6.35	1.0~1.3	8.3~8.7
ø9.52	0.8~1.0	12.0~12.4
ø12.70	0.5~0.8	15.4~15.8
ø15.8	0.5~0.8	18.6~19.0
ø19.05	0~0.5	23.3~22.9

Leakage /Freon - 4/4

Case-4

Factor	Flare nut's fastening.
Troubles & Causes	Damaged flares by over-fastening make gas leakages. And incompletely fastened nuts too.

Defect Details



Guidelines

■ Fastening Torques of Flare Nuts

Tube Dia.(mm)	Torques (Kg-Cm)
6.35	160~200
9.52	350~450
15.88	450~550
19.05	550~650

■ Torque-wrench is required for proper fastenings.

■ Check gas leakages of 4 fastened points and welded points with soap bubbles etc.

-High pressure points: amid compressor's running.

-Low pressure points: amid compressor's not running.

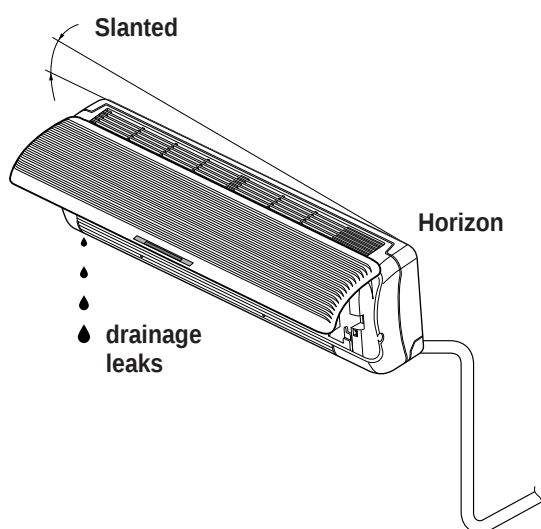
Leakage / Drainage - 1/5

Case-5

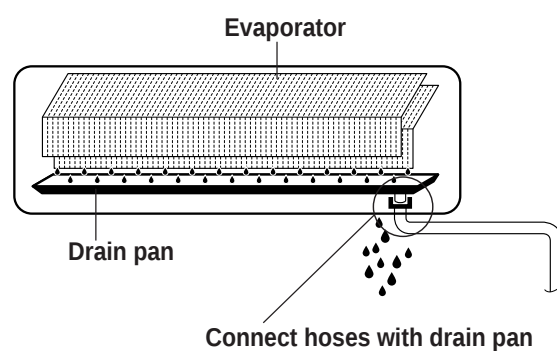
Factor	1. Indoors leveling 2. Drain hose connecting.
Troubles & Causes	Water leaks caused by the inclined indoor unit and the drain hose's bad connecting.

Defect Details

1. Non-leveled indoor



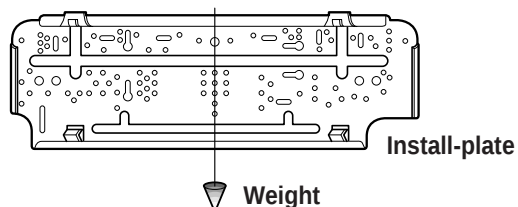
2. Mal-linked drain hose



Guidelines

- Indoors need to be leveled.
(For a better drain the install-plate may be tilted 2~3° to drain-pan's drain side)

- Confirm the water draining is good or not by poring water into the drain pan.
- Connecting parts of drain pan and hose should be well fixed with bond for waterproofing.



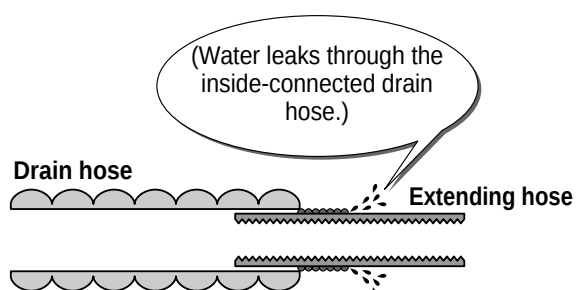
Leakage / Drainage - 2/5

Case-6

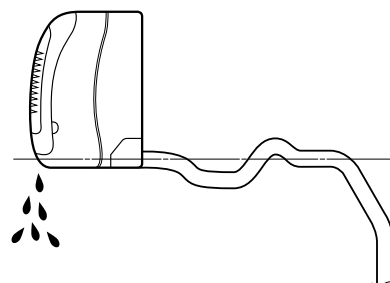
Factor	1. Drain hose extend(adding another hose). 2. Drain hose laying.
Troubles & Causes	Water leaks came from the extending or laying work of drain hose.

Defect Details

1. Improperly extended drain hose.



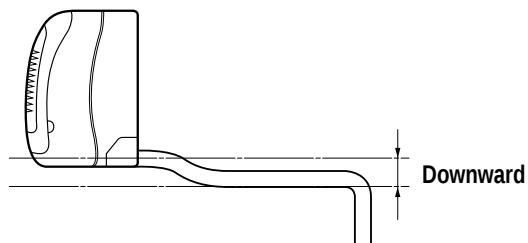
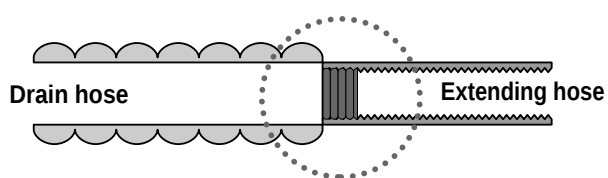
2. Curved or upward drain hose.



Guidelines

- Connect the extending hose outside and seal with bond and finish by taping.

- Install the drain hose straightened and downward.



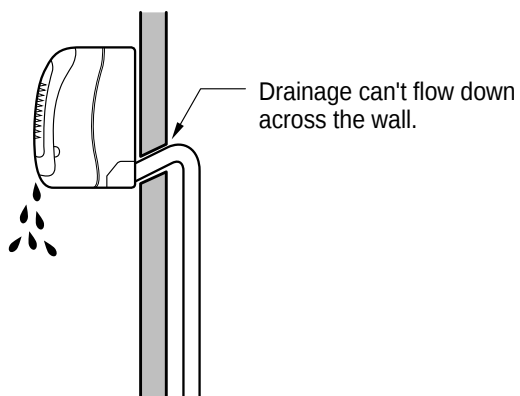
Leakage / Drainage - 3/5

Case-7

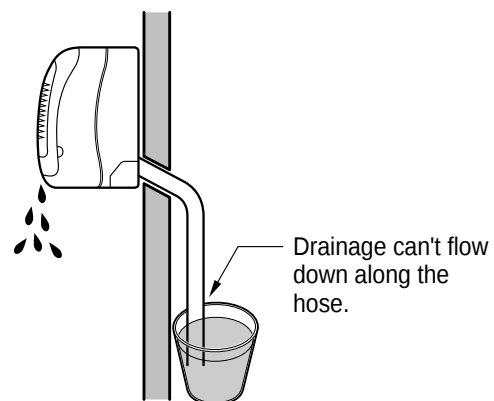
Factor	Drain piping and ending.
Troubles & Causes	Water leaks caused by upwarded drain hose along the wall-through hole and clogged drain hose with water.

Defect Details

1. Upwarded drain hose along the wall-through hole.



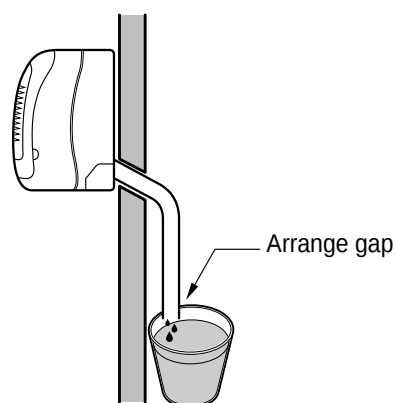
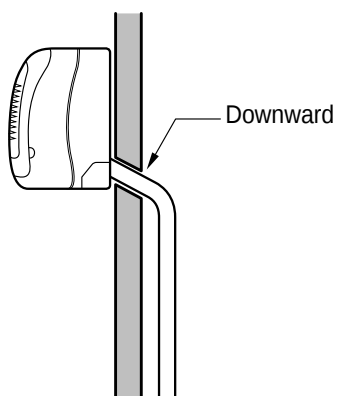
2. Clogged drain hose with water.



Guidelines

■ The wall-through hole should be downward.

■ Don't make drain hose clogged with water.



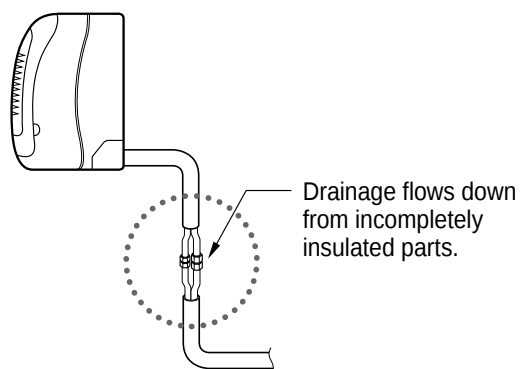
Leakage / Drainage- 4/5

Case-8

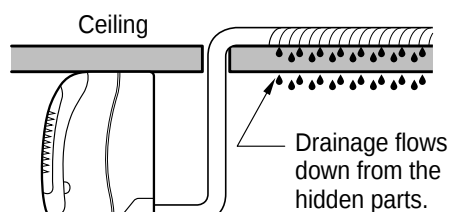
Factor	Insulation work on connecting parts and hidden parts of tubings.
Troubles & Causes	Water leaks caused by wrong insulation works on tubing lines.

Defect Details

1. Incomplete insulation works on tube connecting parts.

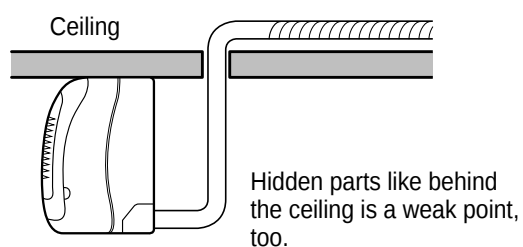
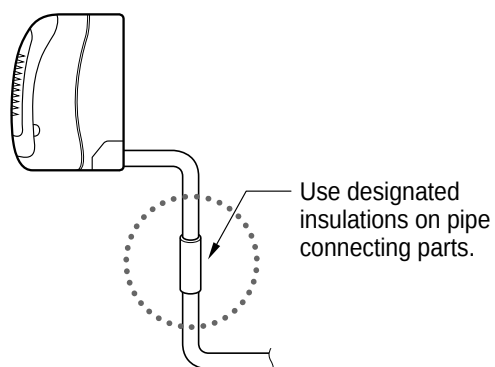


2. Un insulated hidden parts.



Guidelines

■ Completely insulate weak points like pipe-connection and hidden parts.



Leakage / Drainage -5/5

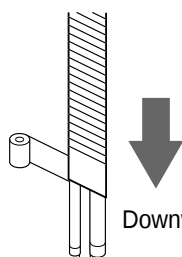
Case-9

Factor	Tubing and taping works against the waterdrops.
Troubles & Causes	Water leaks by the waterdrops led by wrong tubing and taping works.

Defect Details

1. Pipe from upside lead waterdrops(rain, drainage etc.) into the room.

2. Wrong taping direction lead waterdrops into the room too.



Downward

outdoor unit

Outdoor unit

Waterdrops

Guidelines

■ Make U-trap against the waterdrop inflow.

■ tapings should be upward form downside.

Upward



Taping direction

Outdoor unit

Indoor unit

U-trap

Freon shortage

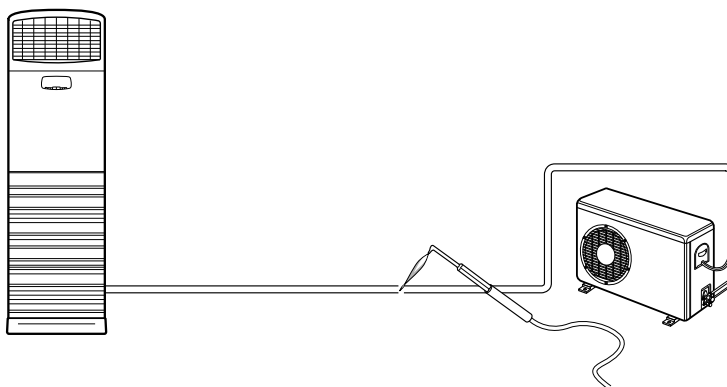
Case-10

Factor	Tube Extending and freon adding.
Troubles & Causes	Cooling capacity downs by the freon shortage.

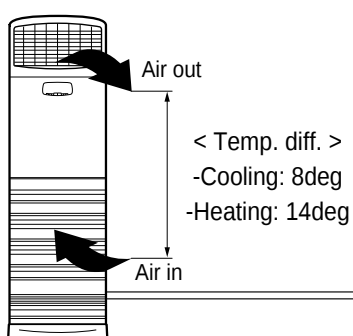
Defect Details

1. Not adding freon for extended tubings.

2. Gas leakage on welded points for extending tubings.

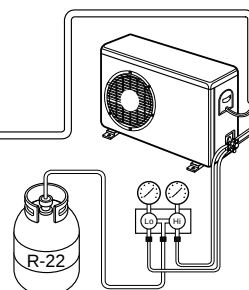


Guidelines



■ Ensure to add freon after extending tubings.(For a simple check of proper freon quantity, compare the in-and-out air temperature after 15 m in from compressor's running.)

■ Detect the gas leakages before insulation tubing(confirm new welded points).



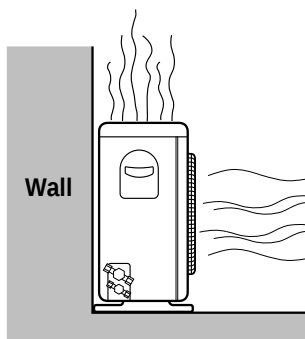
Cooling capacity - 1/5

Case-11

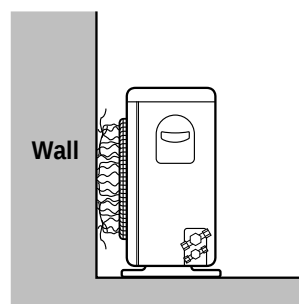
Factor	Spacing for the air flows in split type air conditioners.
Troubles & Causes	Cooling capacity downs by bad air flows.

Defect Details

1. The space for air intake is too narrow.

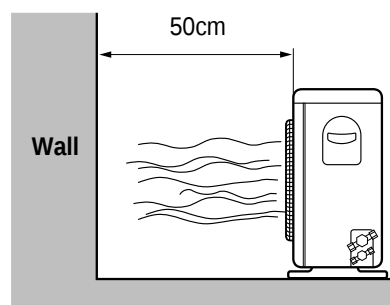
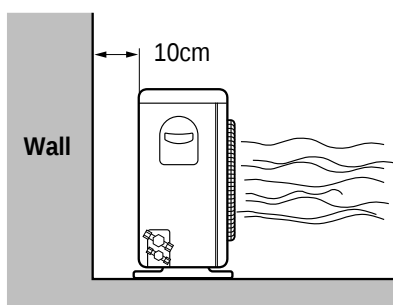


2. The space for air discharge is too narrow.



Guidelines

■ Ensure the distance needed for air flows.



■ Bad air flows lead cooling capacity's drop.
 (The product may not run normally as the accumulated heat make compressor stop by protecting device's work like PTC)

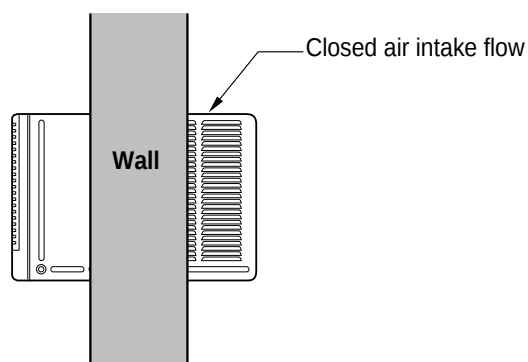
Cooling capacity - 2/5

Case-12

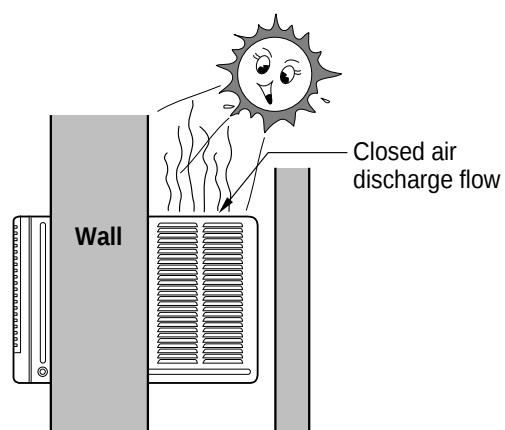
Factor	Spacing for the air flows in window type air conditioners.
Troubles & Causes	Cooling capacity downs by bad air flows.

Defect Details

1. The space for air intake is too narrow.

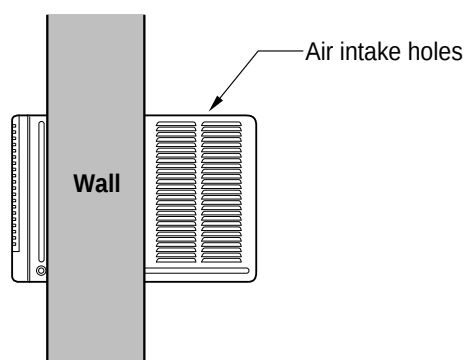


2. The space for air discharge is too narrow.

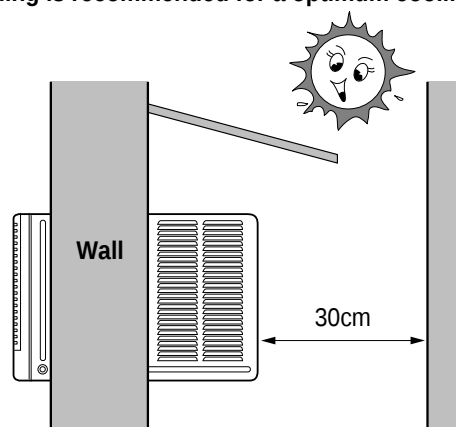


Guidelines

■ Ensure not to disturb the air intake flows.



■ Ensure not to disturb the air discharge flows. The awning is recommended for a optimum cooling.



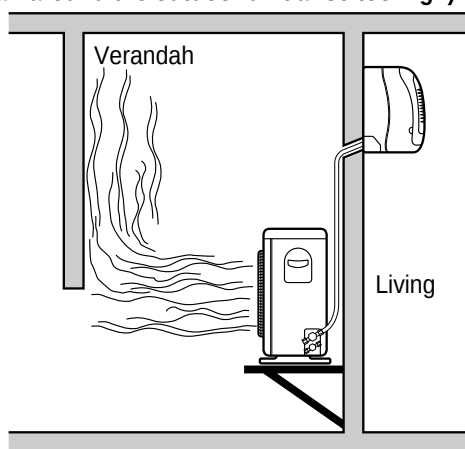
Cooling capacity - 3/5

Case-13

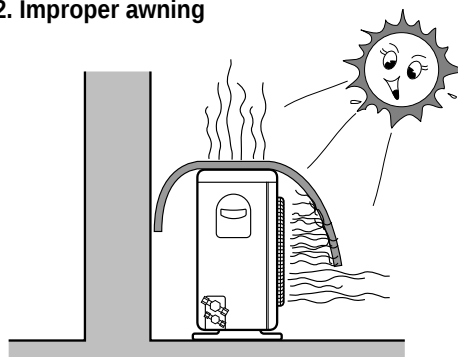
Factor	Improper installation and awning for outdoor unit.
Troubles & Causes	Cooling capacity downs by improper air flows and awning.

Defect Details

1. The outdoor shut in a verandah does not work normally.
(The air around the outdoor unit arise too high)

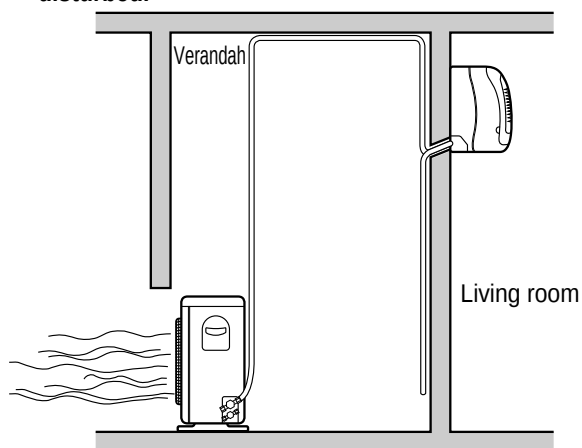


2. Improper awning

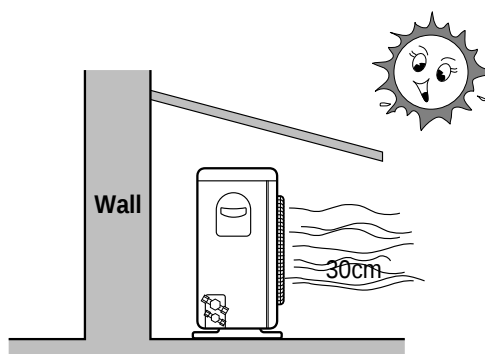


Guidelines

- Discharged air should be outward and not disturbed.



- Establish a proper awning.

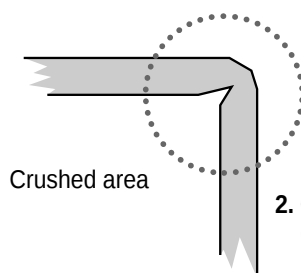


Cooling capacity - 4/5**Case-14**

Factor	Using crushed tubes and changed tubes.
Troubles & Causes	Cooling capacity downs by the crushed tubes and changed tubes.

Defect Details

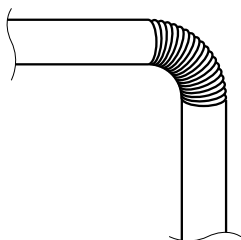
1. Crushed tube by improper bending works.



2. Changed tubing from specified tubes.
(Not using proper tubes designed for each product.)

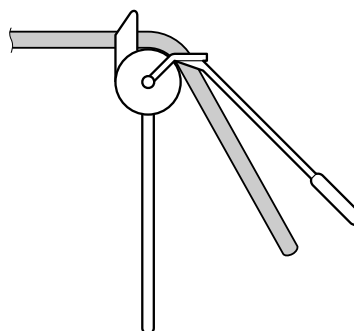
Guidelines

- To get a good shaped tube after bending, use specified spring or bending tools.



(Spring for bending)

- In changing air conditioning unit, the tubes too should be changed with proper ones.



(Bending tool)

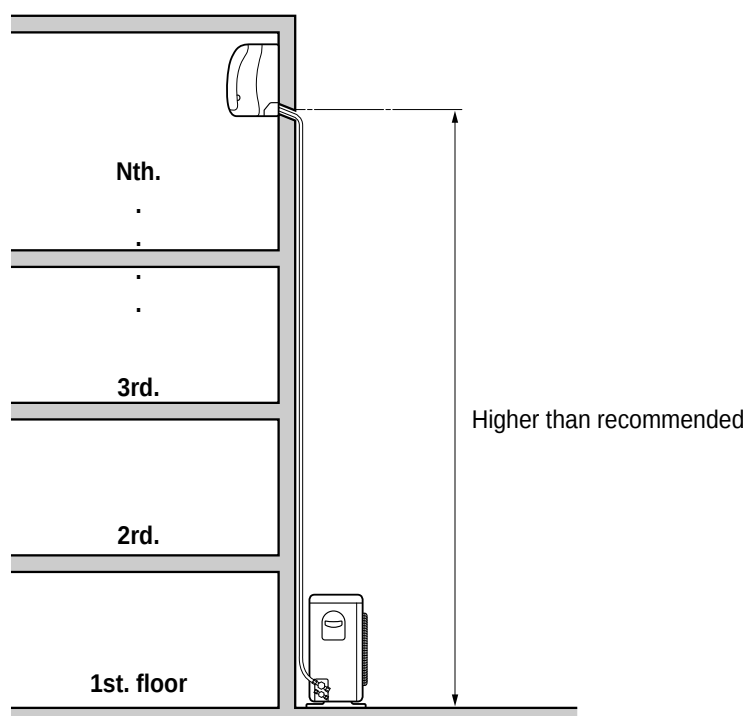
Cooling capacity - 5/5

Case-15

Factor	Long distance tubings.
Troubles & Causes	Cooling capacity downs by long distance tubings.

Defect Details

- Installed too high beyond recommended height difference between indoor and outdoor unit.



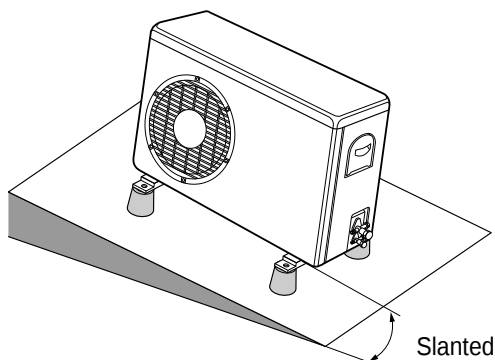
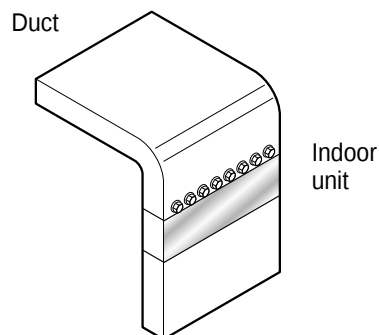
Guidelines

- Recommending maximum distances between indoor and outdoor unit:

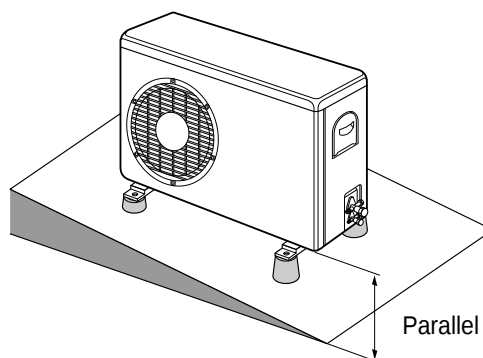
- RAC (Split): vertical=5m, horizontal =10m
- PAC (3.0 HP i Ø): vertical=5m, horizontal=10m
- PAC (3.5 Hp i Ø): vertical=5m, horizontal=20m

Noise - 1/2**Case-16**

Factor	Unstable installing units.
Troubles & Causes	Noise from the unstably installed parts and units.

Defect Details**1. Unstable installed outdoor unit.****2. Released fittings and fasteners.****Guidelines**

- Install the unit balanced stably using specified legs etc.



- To prevent vibrations and noises, fasten tightly all the connecting parts for electric heater, steam line, air duct line etc.

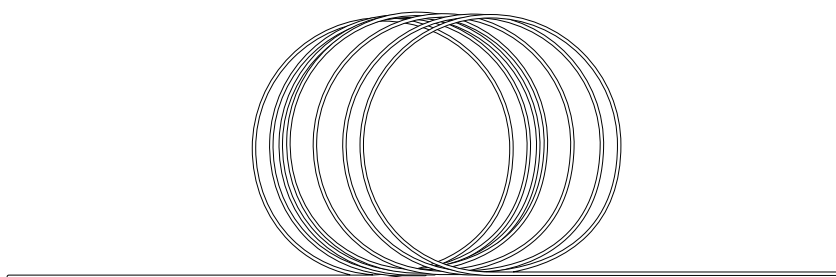
Noise - 2/2

Case-17

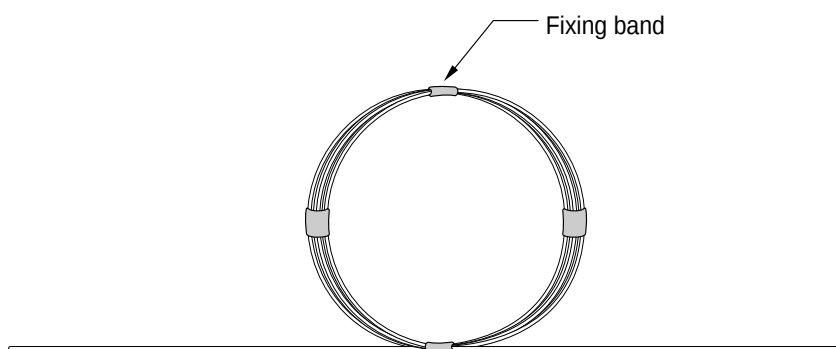
Factor	Unstably fixed tubings.
Troubles & Causes	Noise and vibration form the tubings.

Defect Details

- Unstable fixing of surplus tubings will make vibrations and noises during the compressor's running.

**Guidelines**

- Cut away the surplus tubings.
But if there are any surplus tubings left for some reasons, be sure to fix them stably with fixing bands.



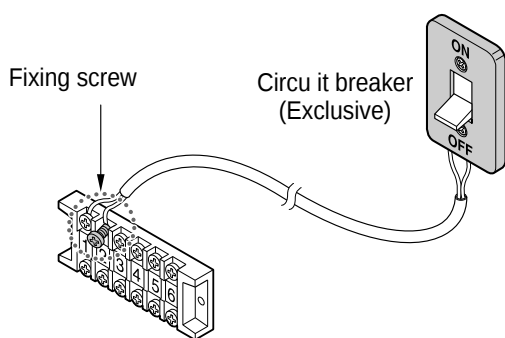
Wiring mistake -1/2

Case-18

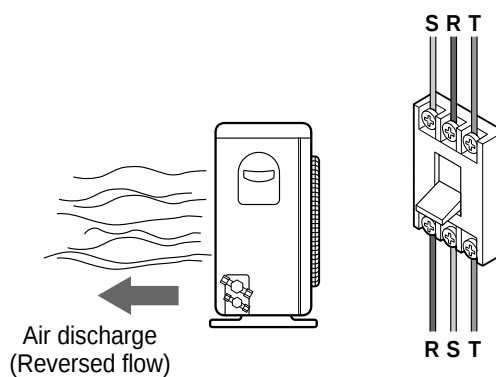
Factor	Wiring in 3 phase electric power lines.
Troubles & Causes	Major electrical problems(not operating properly) by bad wirings.

Defect Details

1. Not firmly fixed screws of electric power lines.(It can be led to critical accidents)

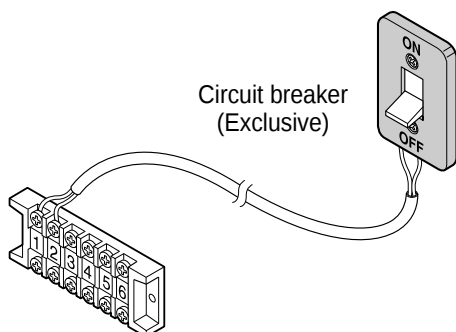


2. Wiring mistake of fan's electric power lines for outdoor.(Fan rotates reversely and the unit will be shutdown with overload.)



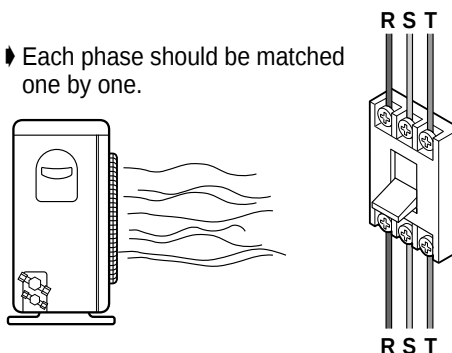
Guidelines

■ Fix screws firmly.



■ Confirm the R-S-T phase lines respectively.

◆ Each phase should be matched one by one.



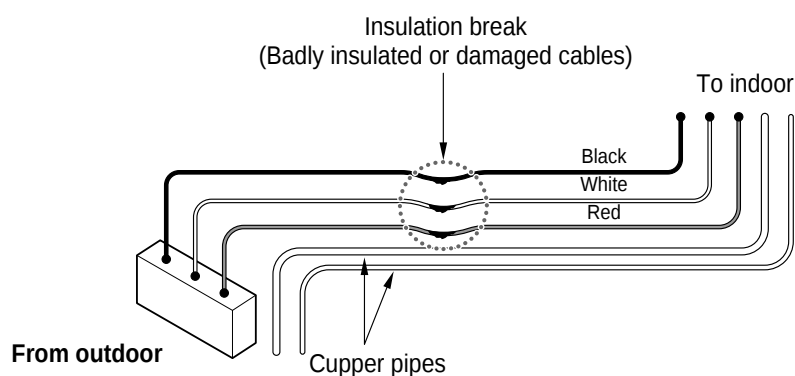
Wiring mistake -2/2

Case-19

Factor	Poor electric insulation.
Troubles & Causes	Major electrical problems(not operating properly) by bad insulations of connecting cables.

Defect Details

■ Poor electric insulations of connecting cables between indoor and outdoor.



Guidelines

How to confirm the correct insulations of connecting cables.
(for the troubles be insulation break)

- Outdoor runs on main electric power's supply.
☐ Short between white and red cables.
- Fuse melts on compressor's running.
☐ Short between red cable and copper pipe.
- Fuse melts on main electric power's supply.
☐ Short between black (or white) cable and copper pipe.
- Main electric braker operates on electric power's supply.
☐ Short between black or white cables.
- Main electric braker operates after 10~20 min from electric power's supply.
☐ Short between black or white cables.
 (Occurs after drainage break into badly insulated parts)

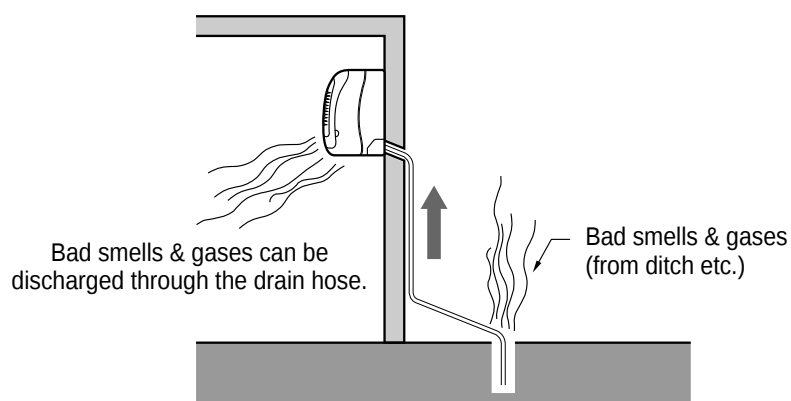
Bad smells & Gases

Case-20

Factor	Bad smells and gases delivered by drain line.
Troubles & Causes	Bad smells and gases from outside(Ex. ditch) are discharged from the system. (Be careful not to be confused as if it's from the system).

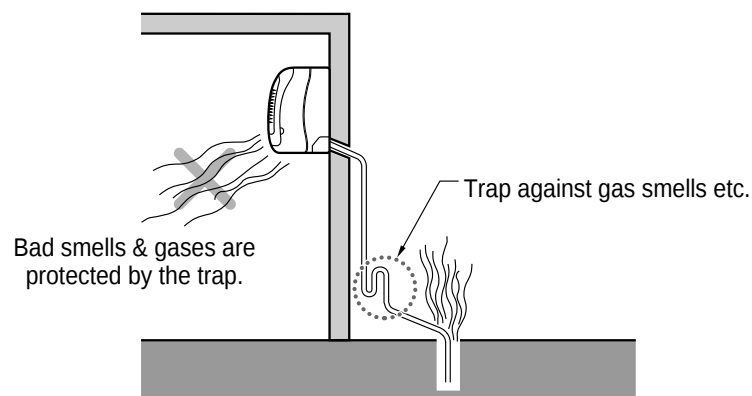
Defect Details

■ Discharging bad smells & gases



Guidelines

■ Add trap on the drain line.



ANNEX 4 R407C REFRIGERANT

1 General

R-407c is a blend of three basic constituents: R32, R125, R-134a with respectively weight composition 23%, 25%, 52%.

R-407c is an HFC refrigerant that does not destroy Ozone layer.

General behaviour of R-407c systems is very similar to standard R22 one; system differences linked to R-407c are below:

- Since R-407c is a zeotropic blend, during phase change, liquid composition is different from vapour one; for this reason in case of leakage in zones with biphasic, residual refrigerant composition could be changed.
- R-407c phase changes are not at constant temperature as in R22 case, but with increasing temperature during evaporation and with decreasing temperature during condensation (Glide effect).

In case of refrigerant recharge, in order to assure correct composition two following steps will have to be followed:

- 1) Residual refrigerant in the system will have to be pulled

out and stored in a disposal cylinder (do not ventilate in ambient).

- 2) **Refrigerant charge will have to be done only with liquid phase** in order to guarantee proper refrigerant composition inside the system; this can be done or using dedicated cylinders with two valves (one for liquid, the other for vapour), or, in case of one valve cylinder, put cylinder in up side down position.

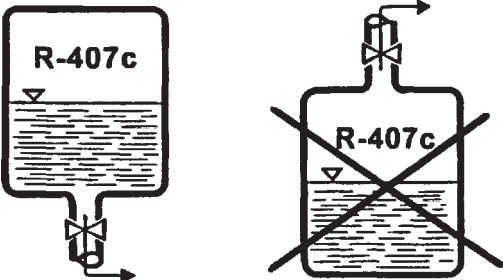
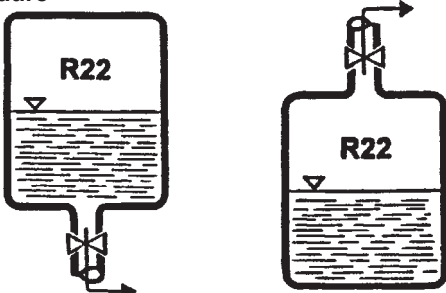
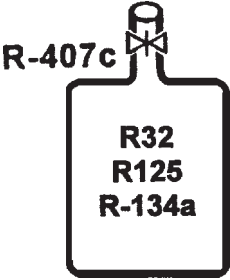
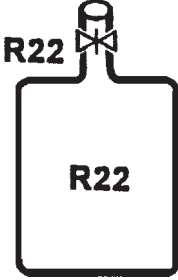
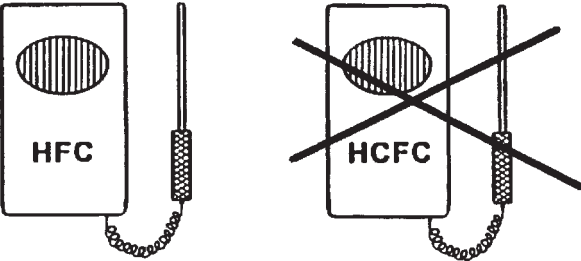
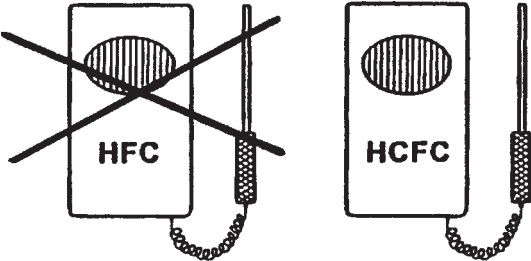
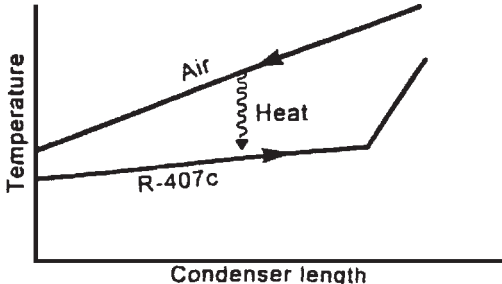
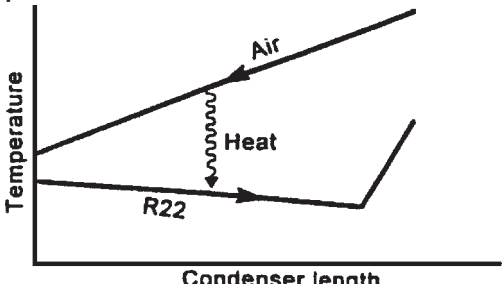
- 3) In case of too much refrigerant charged, it is dangerous to remove partially the charge; this could change refrigerant composition inside the system; in such case it is suggested to remove completely the refrigerant charge, pull vacuum again and recharge the system with proper amount of refrigerant.

Leak detection will have to be carried-out only with HFC sensitive leak detector.

Even if R-407c refrigerant is ozone friendly, do not ventilate it in the ambient because its warming effect is not zero.

For all other technical details see standard for R22.

2 Main differences between R-407c and R22 refrigerant

R-407c	R-22
1. Refrigerant charging procedure 	
2. Refrigerant composition R-407c { R32 23% R125 25% R-134a 52% 	
3. Partial refrigerant charge NOT PERMITTED! Only complete refrigerant charge	YES! Possible partial refrigerant charge
4. Leak detector  Use only HFC detector	 Use only HCFC detector
5. Temperature trend in evaporate 	
6. Temperature trend in condenser 